

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1 1. (Currently amended) An apparatus, comprising
2 a chuck;
3 a plurality of precision ferrules, each having at least one hole therethrough;
4 a plurality of optical fibers;
5 wherein said chuck holds said precision ferrules in an array with hexagonal
6 packing and an end of each of said fibers is bonded within a respective one of said holes;
7 and
8 at least one additional ferrule having at least one hole therethrough that does not
9 have bonded therein a fiber end; and
10 wherein said hole of said at least one additional ferrule that does not have an
11 optical fiber bonded therein is adapted to align said apparatus to a further device to which
12 said apparatus is coupled.

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1 2. (Original) The invention as defined in claim 1 wherein said apparatus is
2 optically coupled to a corresponding other hexagonally packed array.

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1 3. (Original) The invention as defined in claim 2 wherein said other hexagonally
2 packed array is one of the group consisting of a micro electromechanical system (MEMS)
3 having a hexagonal array of micro mirrors, a hexagonally packed array of photo detectors,
4 a hexagonally packed array of light sources.

1 4. (Original) The invention as defined in claim 1 wherein said chuck is fabricated
2 to include at least one flexible member.

1 5. (Original) The invention as defined in claim 1 wherein said holes of said
2 ferrules have an average deviation from the correct positions of less than 3 μm .

1 6. (Original) The invention as defined in claim 1 wherein said holes of said
2 ferrules have a collective displacement of less than 3 μm .

1 7. (Original) The invention as defined in claim 1 wherein said holes of said
2 ferrules have an average angular misorientation of 3.9 or less degrees.

1 8. (Original) The invention as defined in claim 1 wherein said fibers are bonded
2 within said holes using glue.

1 9. (Original) The invention as defined in claim 1 wherein said ferrules are
2 arranged to be perpendicular to a face of said chuck.

1 10. (Original) The invention as defined in claim 1 wherein said ferrules are
2 arranged at an angle to a face of said chuck.

1 11. (Original) The invention as defined in claim 1 wherein said chuck has a
2 hexagonal opening within which said precision ferrules are held in said array with
3 hexagonal packing.

1 12. (Original) The invention as defined in claim 1 wherein at least one of said
2 ferrules has an end with a conical tip.

1 13. (Original) The invention as defined in claim 1 wherein at least one hole of
2 said ferrules has at least one conical entrance.

1 14. (Original) The invention as defined in claim 1 wherein each of a subset of at
2 least two of said fibers has a terminating end that is substantially flush with one end of
3 the one of said ferrules into which said fiber is inserted, and said terminating end of all of
4 fibers said subset being substantially coplanar.

1 15. (Original) The invention as defined in claim 14 wherein at least one of said
2 fibers has a terminating end that not is substantially coplanar with said terminating ends
3 of said subset of said fibers.

1 16. (Original) The invention as defined in claim 1 wherein said precision ferrules
2 are at least two millimeters long.

1 17. (Original) The invention as defined in claim 1 wherein said precision ferrules
2 are ceramic.

1 18. (Canceled)

1 19. (Previously presented) The invention as defined in claim 1 further comprising
2 a layer of a non-rigid material interposed between said chuck and said ferrules that abut
3 said chuck, said material being non-rigid with respect to said chuck and said ferrules.

1 20. (Original) The invention as defined in claim 19 wherein said non-rigid
2 material is at least one of the group consisting of plastic, polyester, polyimide.

1 21. (Canceled)

1 22. (Previously presented) The invention as defined in claim 1, wherein said at
2 least one additional ferrule contains an alignment member protruding therefrom.

1 23. (Original) The invention as defined in claim 1 further comprising a
2 reinforcing sleeve coupled to said chuck.

1 24. (Original) The invention as defined in claim 1 further comprising a
2 reinforcing sleeve integrated with said chuck.

1 25. (Original) The invention as defined in claim 1 further comprising glue in the
2 interstices between said ferrules which acts to couple said ferrules to each other.

1 26. (Original) The invention as defined in claim 1 wherein a face of said
2 apparatus at which said ends of said fibers protrudes is polished.

1 27. (Original) The invention as defined in claim 1 wherein said fibers are cleaved
2 fibers.

1 28. (Original) The invention as defined in claim 1 wherein said chuck has
2 mounting holes within it which are adapted for mounting said apparatus to a further
3 device to which said apparatus is coupled.

1 29. (Currently amended) A method for making a precision fiber array, the method
2 comprising the steps of:

3 securing a plurality of precision ferrules arranged with hexagonal packing in a
4 chuck, each of said ferrules having at least one hole therethrough;

5 inserting a respective optical fiber end into the hole of each of a plurality, but less
6 than all, of said ferrules; and

7 bonding each of said optical fiber ends to its respective one of said plurality of
8 ferrules;

9 wherein said hole of at least one of said ferrules that does not have an optical fiber
10 bonded therein is adapted to align said precision fiber array to a further device to which
11 said precision fiber array is coupled.

1 30. (Previously presented) A method for making a precision fiber array, the
2 method comprising the steps of:

3 securing a plurality of precision ferrules arranged with hexagonal packing in a
4 chuck, each of said ferrules having at least one hole therethrough;

5 inserting a respective optical fiber end into the hole of each of a plurality of said
6 ferrules; and

7 bonding each of said optical fiber ends to its respective one of said plurality of
8 ferrules;

9 wherein said chuck has an interior space in which said ferrules are secured, said
10 securing step further comprising the steps of:

11 heating said chuck to expand its interior space; and

12 inserting said plurality of precision ferrules within said interior space while it is at
13 least somewhat expanded as a result of said heating step.

1 31. (Original) The invention as defined in claim 30 further comprising the step of
2 bonding each of said precision ferrules to each other.

1 32. (Original) The invention as defined in claim 30 further comprising the steps
2 of:

3 bonding each of said precision ferrules to each other; and

4 removing said chuck.

1 33. (Original) The invention as defined in claim 30 further comprising the step of
2 polishing said optical fiber ends.

1 34. (Original) The invention as defined in claim 30 further comprising the step of
2 aligning said optical fiber ends with an optical flat prior to performing said bonding step.

1 35. (Original) The invention as defined in claim 30 further comprising the step of
2 coupling a reinforcing ring to said chuck.

1 36. (Original) The invention as defined in claim 30 further comprising the steps
2 of:

3 securing in said chuck at least one additional precision ferrule having at least one
4 hole therethrough; and

5 bonding an alignment member into said at least one hole of said at least one
6 additional ferrule so that a portion of said alignment member protrudes from said at least
7 one hole of said at least one additional ferrule.

1 37. (Original) The invention as defined in claim 30 further comprising the step of
2 securing in said chuck at least one additional precision ferrule having at least one hole
3 therethrough into which one of said fiber ends is not inserted.

1 38. (Currently amended) An apparatus, comprising:

2 a plurality of precision ferrules tightly held together to form an array with
3 hexagonal packing, each of said ferrules having at least one hole therethrough;

4 at least two optical fiber ends being bonded within the holes of respective ones of
5 said ferrules; and

6 wherein at least one hole of at least one of said precision ferrules does not have an
7 optical fiber end bonded therein; and

8 wherein said hole of said at least one of said precision ferrules that does not have
9 an optical fiber bonded therein is adapted to align said apparatus to a further device to
10 which said apparatus is coupled.

1 39. (Original) The invention as defined in claim 38 wherein said precision
2 ferrules are held together by glue.

1 40. (Original) The invention as defined in claim 38 wherein said precision
2 ferrules are held together by a chuck.

1 41. (Original) The invention as defined in claim 38 wherein said apparatus is
2 arranged so that said optical fiber ends are pointing in substantially exactly the same
3 direction.

42. (Canceled)

1 43. (Previously presented) The invention as defined in claim 38 wherein said hole
2 of said at least one ferrule that does not have an optical fiber end bonded therein has an
3 alignment member bonded therein and protruding therefrom so as to be adapted to align
4 said apparatus to a further device to which said apparatus is coupled.

1 44. (Original) The invention as defined in claim 38 further comprising at least
2 one additional ferrule having at least one hole therethrough, wherein said hole of said at
3 least one additional ferrule is adapted to receive an alignment member whereby said
4 apparatus is aligned to a further device to which said apparatus is coupled.

1 45. (Previously presented) An apparatus, comprising
2 a chuck;
3 a plurality of precision ferrules, each having at least one hole therethrough;
4 a plurality of optical fibers; and
5 a layer of a non-rigid material interposed between said chuck and said ferrules that
6 abut said chuck, said material being non-rigid with respect to said chuck and said ferrules;
7 wherein said chuck holds said precision ferrules in an array with hexagonal
8 packing and an end of each of said fibers is bonded within a respective one of said holes.

1 46. (Previously presented) The invention as defined in claim 45 wherein said
2 non-rigid material is at least one of the group consisting of plastic, polyester, polyimide.
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